

# Small, NM businesses key factor in Sandia's 2017 economic impact

## 2017 Economic Impact

"Sandia's success is closely connected to the diversity and strength of our suppliers. We are fully committed to nurturing our small business partnerships to achieve our national security mission and furthering economic prosperity."

Jolyn A. Maheras  
Director, Integrated Supply Chain Management

### Subcontract-Related Payments

This represents dollars paid to purchase goods and services. More than 510 new small business suppliers supported Sandia's mission in Fiscal Year 2017 (FY17). Small businesses represent 66 percent of all Sandia suppliers.

### Total Laboratory Expenditures

\$3,124,271,000

### Procurement Card Payments

\$85,688,000

### Gross Receipts, Sales/Use, and Corporate Taxes

\$88,072,000

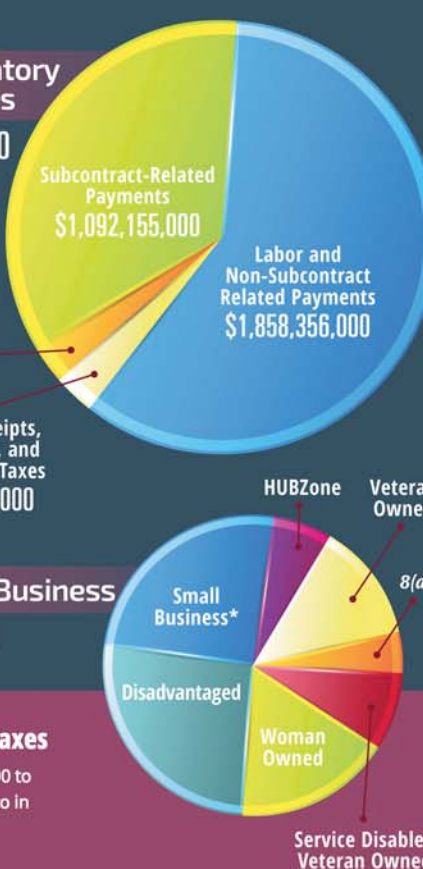
### Total Small Business

\$580,998,000

### Gross Receipts Taxes

Sandia paid \$83,675,000 to the State of New Mexico in gross receipts tax.

\*non-minority, non-woman, non-HUBZone, non-veteran owned



By Nancy Salem

Sandia increased its spending with small companies in New Mexico and nationwide in fiscal year 2017, according to the Labs' latest economic impact report.

"These annual numbers show that Sandia continues to make a positive impact on the New Mexico and national economies, particularly through utilization of small businesses," says Delfinia Salazar, manager of the Labs' Supply Chain Risk Management and Supplier Diversity department.

Sandia spent more than \$1.09 billion in subcontracts and \$85 million in procurement card payments for a total of \$1.17 billion in goods and services from suppliers in FY17, up more than \$55 million from the previous year. Combined subcontract and procurement card purchases to New Mexico businesses topped \$420 million.

New Mexico businesses received more than \$404 million in subcontracts, or 37 percent of the total subcontracting amount. US small businesses received 53 percent of the available subcontract dollars, about \$581 million in Sandia subcontracts. New Mexico small businesses received \$267 million, or 66 percent of subcontract payments to New Mexico companies.

Compared with fiscal year 2016, subcontract spending was up more than \$23 million with New Mexico businesses and up \$27 million with the state's small companies, while procurement card purchases to New Mexico businesses were up \$680,000. Total US small business spending increased by \$51 million.

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HENAAC honors two Sandians  
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# SandiaLabNews

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# Understanding blast impact Modeling, simulations aim to boost understanding of injuries, body armor

By Sue Major Holmes

Sandia is developing specialized computer modeling and simulation methods to better understand how blasts on a battlefield could lead to traumatic brain injury and injuries to vital organs, like the heart and lungs.

Researchers at the Labs have studied the mechanisms behind traumatic brain injury for about a decade. Their traumatic injury modeling and simulation project began with a head-and-neck representation, and now they've created a high-fidelity, digital model of a man from the waist up to study the minute mechanisms behind trauma.

"We're also concerned about the possibility of injury to the life-support systems in the torso. Everything's interconnected," says Paul Taylor, who leads the project. "Clearly, we would love to have a representation of a full human but certainly capturing all the regions where life-critical organs are located is a very good start."

The information could help manufacturers develop better designs for helmets and body armor.

"Protection of the soldier, sailor, airman, or marine is essential, and well aligned with our national security mission against challenging and new lethal threats," says program manager Doug Dederman. "It is a privilege for our integrated military systems staff to team with the Department of Defense and medical communities to improve both diagnostic capabilities and mitigation of risk with improved protective equipment."

Sandia's most recent work grew from a Laboratory Directed Research and Development-funded project



SANDIA RESEARCHERS Candice Cooper, left, Shivonne Haniff, center, and Paul Taylor are studying mechanisms behind traumatic brain injury to better understand how blasts on a battlefield can lead to such injuries and injuries to vital organs, such as the heart and lungs. The 351st Battlefield Airmen Training Squadron at Kirtland Air Force Base, through a connection with Nathan Davey of Sandia, provided the vest armor for the project. (Photo by Randy Montoya)

that wrapped up in late 2016. Along the way, the team conducted both macroscale and microscale traumatic brain injury simulations, began working with doctors to correlate simulation predictions with clinical assessments of people with brain injury, and increased the size of their team.

They theorize that a phenomenon called fluid cavita-

tion can lead to traumatic brain injury. They've developed macroscale simulations to test the hypothesis and extended their work into microscale studies to examine whether blast and short-pulse blunt impact, such as a projectile hitting body armor, could lead to fluid cavitation, forming bubbles whose collapse could damage sensitive brain and lung tissue, Paul says.

### Localized shock waves

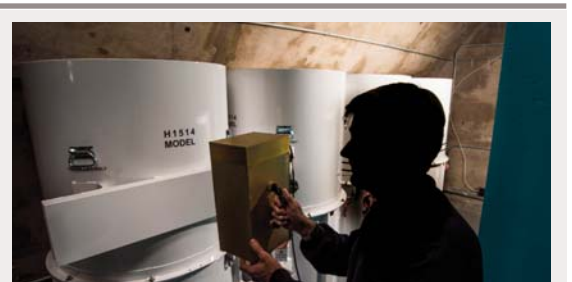
Cavitation is the formation of vapor cavities — bubbles — caused by rapid pressure changes in fluid, which can occur from blast exposure. Bubbles form and, because they're unstable, immediately collapse, generating a microjet or miniature localized shock wave. It's a physics phenomenon commonly seen at the leading edge of spinning ship propellers, eroding those propellers.

"We've been able to demonstrate, at least theoreti-

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That’s that

I’m up to my neck just now in a biography of John D. Rockefeller, the industrial giant behind Standard Oil and father of what we’d now call “Big Oil.” Fittingly, the book is called *Titan: The Life of John D. Rockefeller Sr.* It’s by Ron Chernow, who’s also written well-received biographies of Ulysses Grant, George Washington, and Alexander Hamilton.

*Titan* is a big, sprawling book, ambitious in scope, necessarily so since it tells the epic story of America’s post-Civil War transition from an agrarian society to the planet’s industrial powerhouse.

Rockefeller cut his business teeth in the volatile foodstuffs brokerage industry of the mid-1800s as an entry-level bookkeeper. Very quickly, through brilliance, perseverance, daring, and ambition, he became a partner in the firm by the age of 20. When oil was discovered in Pennsylvania – and more to the point, when it was realized that oil-derived kerosene was a viable alternative to whale oil for lighting – Rockefeller and his partners pivoted from foodstuffs to this promising new commodity, focusing on the refining end of the business.

There’s a lot more to the story of this complex and peculiar man who, on his way to becoming the richest man in America, embodied both the very best impulses and the worst excesses of the era. In many ways, he invented both the modern corporation and the modern approach to big-money philanthropy. As Chernow writes, “What makes him problematic – and why he continues to inspire ambivalent reactions – is that his good side was every bit as good as his bad side was bad. Seldom has history produced such a contradictory figure.”

Anyhow, what brings me to this subject is a paragraph from an early chapter of the book, at a point in his life where Rockefeller’s fortunes were tied almost totally to Pennsylvania oil.

“In 1875,” Chernow writes, “Henry Wrigley, the head of the Pennsylvania Geological Survey, issued a doomsday warning that the state – and hence the world – production of oil had peaked and would soon experience a precipitous decline, aggravating fears that had overshadowed the oil industry since its inception. Within months his forecast was refuted when a new field was discovered in Bradford, Pennsylvania.”

That passage has a familiar right to it; it wasn’t that long ago that we were hearing similar prognostications – in almost the same terms – about the global oil supply. For better or for worse, the most recent predictions of the imminent end of the era of oil seem to be as unfounded as were those of the head of the Pennsylvania Geological Survey, whose thoughts about peak oil were based on the limited parameters within which he analyzed the problem:

- All the world’s oil is in Pennsylvania;
- they’re pumping it out at unsustainable rate;
- therefore, the supply is bound to run out and we’ll soon be

back to hunting Blue Whales in the Southern Ocean.

What Wrigley didn’t take into account was that it turns out that oil, in one form or another, seems to be everywhere, if only you can figure out how to get to it.

None of this is to ridicule those who have argued the case for peak oil. For now, humankind’s ingenuity appears to have forestalled The End, but the concerns raised by the peak oil discussions of a few years back have served a useful purpose, obliging us to contemplate a post-fossil fuel future and begin to take the steps to adapt to it.

True, we aren’t going to run out of oil tomorrow, but surely at some point sooner or later the last barrel of oil will be fracked, pumped, squeezed, sucked, or massaged out of the ground. When that happens – long before that happens – we need to be ready. And Sandia’s deeply involved in helping the world prepare. Our portfolio includes research in solar, wind, tide, biofuels, hydrogen, “conventional” nuclear power, and – the Holy Grail – fusion. Alternatives to oil? We’re on it. As mathematician Ian Malcolm said in *Jurassic Park*: “Life finds a way.” And so does Sandia.

The work we do here will help us transition to the post-fossil fuel era long before the specter of peak oil rears its head again. That’s a great mission for a national laboratory.

See you next time.

Safety Topic of the Month



FEBRUARY Overexertion

Overexertion is working beyond our body’s physical limits, resulting in injuries such as fatigue, low blood sugar, dehydration, and repetitive use injuries. To lower your risk of these issues, recognize and respect your body’s limits. Overexertion is one of the top causes for recordable employee injuries at Sandia.

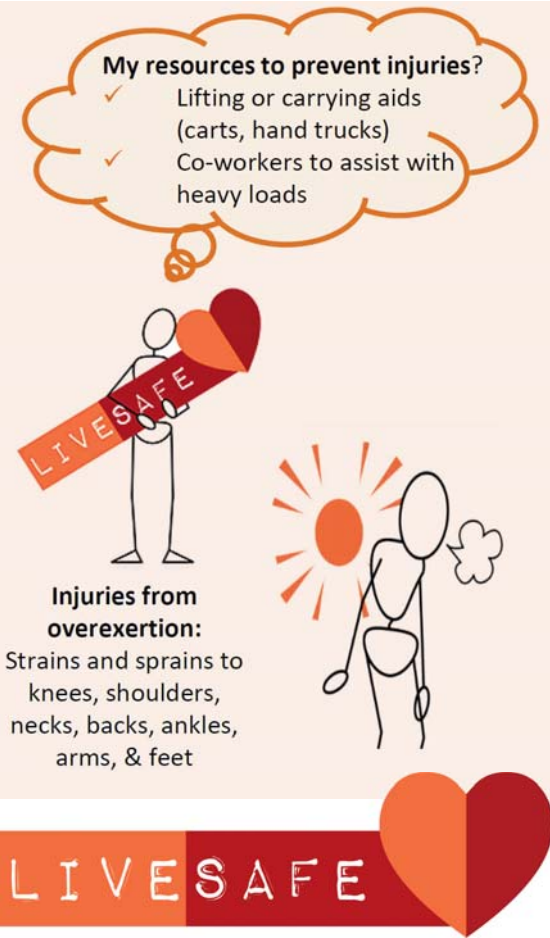
Physical overexertion is not just a workplace risk. Other causes of overexertion injuries include:

- sports and exercise
- motion-control video games, such as those played on the Nintendo Wii and PlayStation Move
- hobbies like woodworking, building, and remodeling

Preventing overexertion

- Slow down. Work at a steady pace, taking one task at a time. Plan your work day to get the needed work done without overtaxing yourself.
- Know your limits. Ask for help or use mechanical aids to move heavy or large items.
- Maintain good posture. Take the time to position your body properly when sitting at your desk or performing work tasks.
- Use proper techniques. When lifting, bend your knees and avoid over-reaching or twisting. When carrying, hold items close to your body.
- Take frequent mini-breaks. When performing a strenuous or repetitive task, take short breaks to allow your muscles to relax and recover.

More info at [livesafe.sandia.gov](http://livesafe.sandia.gov)



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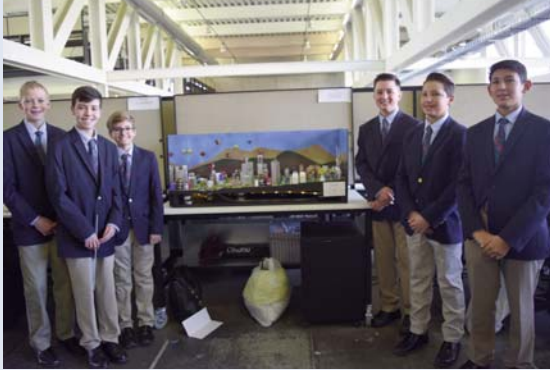
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Imagine. Design. Build. Future Cities challenge 2018



THE VIDA SANA TEAM from Annunciation Catholic School in Albuquerque took first place in this year’s New Mexico Future City competition in January and will represent the state in the national competition in Washington, D.C., Feb. 18-21. The theme of this year’s competition is “Age Friendly City,” aimed at creating infrastructure to accommodate various age groups. The Future City competition is a national, project-based learning experience in which middle school students imagine, design, and build cities 100 years in the future, working in teams with an educator and a mentor. Teams plan a city using SimCity software; research and write solutions to an engineering problem; build table-top scale models with recycled materials; and present their work to a panel of judges. Sponsors of the regional event included Sandia and Los Alamos national laboratories; National Technology & Engineering Solutions of Sandia LLC; Los Alamos National Security LLC; and the University of New Mexico School of Architecture & Planning.



# Sandia supplies essential element to local science classrooms

By Jules Bernstein

Thanks to a donation by Sandia, public high schools in Livermore now sport colorful, extra-large periodic tables that include the city's name-sake element, Livermorium.

Livermorium is a synthetic element discovered though experiments at Lawrence Livermore National Laboratory and the Joint Institute for Nuclear Research in Russia. The International Union of Pure and Applied Chemistry adopted it in 2012.

"Our science teachers at both Livermore and Granada high schools are thrilled to have current periodic tables that include all of the elements, especially Livermorium," says Livermore Valley Joint Unified School District Superintendent Kelly Bowers.

The idea to donate the custom designed, up-to-date periodic tables came from conversations last fall between Sandia Community Relations Officer Madeline Burchard and local Livermore science teachers. The teachers indicated then that their classroom tables were outdated and missing new elements including Livermorium and Lawrencium.

Madeline, who holds a degree in molecular environmental biology from the University of California, Berkeley, believed this was something Sandia could and should help fix.

"My own chemistry teachers in college had me memorize the table because the information it contains is so crucial for understanding how atoms interact with each other," she says.

Madeline worked with Sandia designer Loren Stacks to create the 6-by-4 tables, then surprised the teachers



LIVERMORE HIGH SCHOOL life science teacher Elias Fiadoyor poses with his classroom's new periodic table of elements.

with them in their department meetings this fall. Reaction has been universally positive from both teachers and students.

Granada high school senior and Sandia intern Emma Zika says, "I think the tables are going to be really useful tools, especially for the freshmen and sophomores at the beginning of their science journeys." In reference to Sandia's thunderbird logo on the tables, Emma adds, "It's really cool to see Sandia represented on campus, and to know the Laboratories care about our education."

Livermore High School life science teacher Elias Fiadoyor says that prior to receiving his table, the one in his classroom was very small. "This one, students all the way in the back will be able to see it! I will have to find a way to cover it during exams," he jokes.

Smaller, 8.5-by-11 versions of the larger tables are available for downloading and printing.

The table donations are part of Sandia's long-standing efforts to engage with and support the local community. Other popular community involvement programs that Sandia sponsors include:

- Family Science Night — a traveling science fair that sets up weekly at different elementary schools in the San Joaquin and Tri-Valley areas.
- Sandia Regional Science Bowl — a quiz-bowl-style,



GRANADA HIGH SCHOOL science teachers pose with Sandia Community Relations Officer Madeline Burchard (center), with a new wall-size periodic table. (Photos by Jules Bernstein)

fast-paced science competition that tests local middle and high school teams on their knowledge in a range of scientific disciplines, including biology, chemistry, earth sciences, physics, and math. The winning team is sent to Washington, D.C., to represent the region in a national competition.

• Sandia Women's Connection Math and Science Awards — This awards program recognizes high-achieving young women for their accomplishments in science, technology, engineering, and math subjects, and encourages their future scholarship by pairing them with Sandia mentors. Nominees are selected by teachers from more than 16 Northern California high schools.

"We live in a community rich in scientific research and innovation," says Bowers. "Sandia's strong partnership with our schools, exemplified by this donation, will help ensure our students stay on the cutting edge of scientific discovery."

## Sandia donates \$25,000 to Valley Children's Museum

By Michael Padilla

Sandia has donated \$25,000 to the Valley Children's Museum in Dublin, California. The grant, made possible through Sandia's gifts and grants program, will be used to update the museum's exhibit space and curriculum with engineering-themed activities.

"Sandia is honored to be a partner in bringing the world of engineering to San Francisco Bay Area youth and adults," Madeline Burchard, community relations officer at Sandia/California, says. "We believe science and engineering is fun and we are excited to inspire children to believe so too. This grant is one of many ways Sandia is supporting our local communities."

The Valley Children's Museum aims to inspire lifelong learning in children and families through activities and exhibits that feel like play. The museum is known among Bay Area families for its California mission exhibits. The history of Spanish missions is a part of the fourth-grade curriculum in California elementary schools. With the support of Sandia, engineering-themed activities and curriculum will be added.

In addition to financial support, the museum will benefit from Sandia's greatest resource, its people. Technical

staff from Sandia are invited join the museum's advisory committee to assist with the museum's exhibit makeover. Rachel Wallace, an executive strategy specialist at Sandia, serves on the Valley Children's Museum board of directors and says she looks forward to helping guide the direction and implementation of a children's museum in the Tri-Valley area.

"Sandia's grant to the museum to upgrade its current mobile museum experience is immensely impactful," Rachel says. "Valley Children's Museum will be able to completely update the current exhibits, with a new focus on science, technology, engineering, and mathematics."

Rachel says the creation of fun, play-based engineering exhibits and activities in the museum will allow children to engage with STEM in an approachable and interactive way, opening a world of scientific and engineering discovery they might not have access to in their daily life.

"This access to STEM is such a tremendous benefit to everyone in our region," she says. "I hope this will inspire the next generation of scientists and engineers in our community to change the world."



VALLEY SUPPORT — Madeline Burchard, center, community relations officer at Sandia/California presents a check to Valley Children's Museum board members, left, Rick Beaumont, Ed Duarte, second from left, and Loren Behr. The \$25,000 grant will be used to update the museum's exhibit space and curriculum with engineering themed activities. (Photo by Michael Padilla)



# Blast simulations

(Continued from page 1)

cally, that the individual experiences fluid cavitation in the brain. We’ve subjected our head-neck model to blast from the front, from the side, from the rear, and what we see are what looks like peppered regions in the brain,” localized regions experiencing cavitation, Paul says, pointing to the occipital, temporal, and brain stem areas on a slide from a simulation.

“Does cavitation occur, and if so, where might it be occurring?” says team member Candice Cooper, who developed the macroscale simulation. “Then we look at those areas on the microscale to see if cavitation is indeed occurring, how might it damage these tissues and lead to traumatic brain injury.”

The smallest area in the macroscale simulation is 1 cubic millimeter, which isn’t small enough to capture the physics of fluid cavitation very well, Paul says.

## White matter axons

Enter Shivonne Haniff, who performs microscale modeling and simulation to complement Candice’s macroscale work, simulating the formation and collapse of cavitation bubbles in the brain in scales below 1 millimeter.

One of Shivonne’s models represents axonal fiber bundle tracks within the brain’s white matter. Typically, white matter axons have myelin sheathing, a protective coating, similar to how insulation protects electric wiring. Myelin sheathing accelerates neurological pulses, allowing humans to process information very quickly. Diseases, such as multiple sclerosis, degrade myelin sheathing and drastically reduce pulse transmission.

The team hypothesizes that blast- and impact-induced cavitation and subsequent bubble collapse also could damage myelin sheathing.

Shivonne’s video of a microscale simulation of cavitation bubble collapse within the white matter axon fiber bundle introduces a pressure pulse from one side, causing asymmetric collapse of the bubbles, generating highly localized pressure pulses and microjetting that

damages neighboring axons and their myelin sheathing.

The team studied how compressive wave amplitude and bubble size influenced microjetting strength.

“To assess damage potential from bubble collapse-induced microjetting, we looked at pressures and shear stresses downstream of the bubbles. The shear stresses in the myelin sheathing were considerably higher than the shear stresses in the axon core, indicating the myelin acts as a protective barrier,” Shivonne says. “However, damage to this myelin sheathing could impair the transmission of nerve signals, which can lead to neurological problems.”

She is focusing now on modeling cavitation dam-

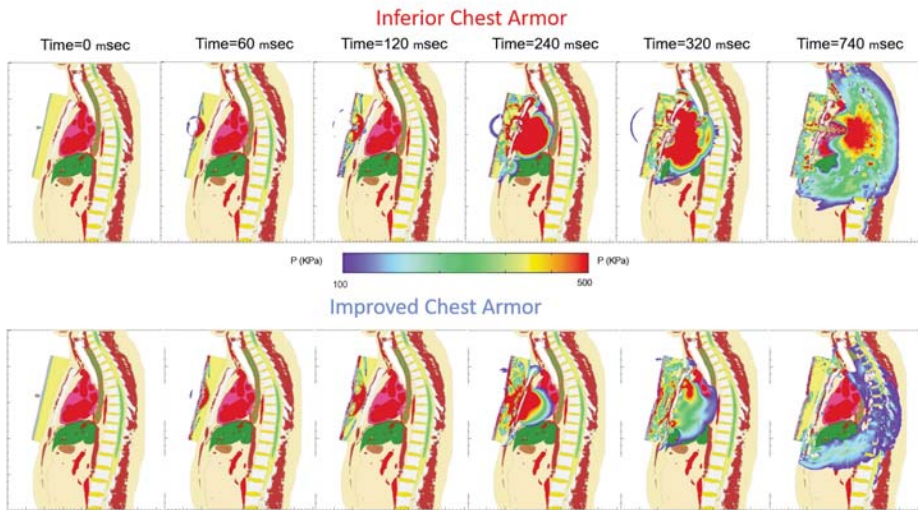
aged at understanding the modeling problem rather than reaching conclusions applicable to specific armor. Her simulation studied pressures within the heart, lungs, and other organs in different scenarios, such as a soldier standing about 10 feet from a roadside bomb blast.

“We looked at pressure as well as the shearing stress that can lead to tissue tearing, and found that in this notional case, having padding behind the armor actually increased peak pressures in life-critical organs, the heart and the liver, which could lead to damage,” Candice says. “It also led to an increase in shear stresses in all of the organs that we looked at.

“This is just an example of how we can use our modeling and simulation tools. If someone came to us with their armor design and said, ‘Would you take a look at this,’ we could vary the materials of the foam padding, the positioning of the foam padding, the size or geometry of the foam padding or of the armor plate itself,” she says. “We could look at variations on their design and let them know this change makes it better, that change makes it worse.”

The project has a long-term association with Dr. Corey Ford at the University of New Mexico Health Sciences Center and a more recent one with the Air Force San Antonio Military Medical Center. Candice, Paul, and team member Chad Hovey recently presented their research at the International Mechanical Engineering Congress & Exposition, work that was funded through the Military Medical Center. Shivonne and Paul gave a presentation at the same conference, outlining microscale cavitation studies, work funded by the US Office of Naval Research by Dr. Tim Bentley, and published a paper on the topic in a recent edition of *Shock Waves*. The fifth team member, Ryan Terpsma, has assisted in macroscale modeling of behind-helmet blunt trauma resulting from bullet impacts.

The team also works with experimental collaborators at Los Alamos National Laboratory, New Mexico Tech, its Energetic Materials Research and Training Center, and Michigan State University, some of whom perform blast tube experiments on a physical model. The project recently began working with Team Wendy, a company that manufactures military and civilian helmets.



HUMAN MODELING AND SIMULATION — Sandia researchers illustrate their ability to use human modeling and simulation work to compare two notional chest armor designs varying in thickness and material properties. The top row shows a projectile hitting the inferior chest armor design, which failed to keep the projectile from penetrating the chest of the torso model. The bottom row illustrates an improved design. The images show pressure being transferred from the projectile into the torso and moving through the internal organs, which could lead to behind-armor blunt trauma injury.

age within the blood-brain barrier, a semi-permeable vascular system that allows passage of nutrients and gases needed by the brain but blocks harmful toxins. A video simulation shows cavitation bubbles suddenly collapsing under pressure, drastically increasing pressure and shear loading on surrounding tissue, which can damage it. Simulations look at the effects of different bubble diameters, bubble density, and pressure wave amplitudes on the degree of damage.

## Modeling damage mechanisms

Candice also conducted modeling and simulations for a generic body armor configuration. The work was

# Economic impact

(Continued from page 1)

The 2017 Sandia National Laboratories Economic Impact brochure breaks down Sandia’s spending and spotlights its role in the economy. The 2017 data, reflecting actual payments made, is based on Sandia’s fiscal year from Oct. 1, 2016, to Sept. 30, 2017.

“We continue to set and achieve aggressive small business and supplier diversity goals,” Delfinia says. “Examples of our commitment include our increased subcontract awards to Historically Underutilized Business Zone [HUBZone] companies, where those dollars are critically needed, and to Service-Disabled Veteran-Owned companies that continue to contribute to our national security missions.”

## Small businesses, diverse suppliers wanted

Sandia reaches out to local businesses through a variety of programs. It holds public forums with suppliers and civic leaders to discuss subcontracting opportunities and lists subcontracts on its Business Opportunities website. It supplies small and diverse business owners with information on doing business with Sandia and seeks qualified suppliers.

In October 2016, Sandia began hosting open houses to meet personally with business owners and representatives. In the first year, more than 330 visitors from more than 260 companies attended, meeting with subcontract managers, supplier diversity advocates, other Sandia personnel and members of the Labs’ Small Business Procurement Technical Assistance Program.

In FY17, Sandia added more than 510 new small businesses to its supplier base.

Sandia’s overall economic impact in 2017:

- \$1.858 billion was spent on labor and non-subcontract-related payments.
- \$1.092 billion went to subcontract-related payments.
- \$83 million went to the state of New Mexico for gross receipts tax.
- \$85 million was spent through procurement card purchases.

The report demonstrates Sandia’s continued commitment to small business, Delfinia says. The Small Business Act mandates that federal contractors use



TEF CONSTRUCTION INC. vice president Tom Foster, left, TEF owner Mary Foster, center, and accountant Emily Miller, their daughter, study plans for a building project at Sandia National Laboratories. The small, woman-owned business has been a Sandia contractor 22 years. (Photo by Randy Montoya)

small businesses, including those that are small disadvantaged, owned by women or veterans and service-disabled veterans, and small businesses in impoverished, HUBZone areas. Sandia’s Supplier Diversity department oversees the mandate and negotiates small business subcontracting goals with NNSA.

“Looking ahead to fiscal year 2018, Sandia is committed to identifying and partnering with a diverse supplier pool in support of Sandia’s national security mission and small business goals,” Delfinia says. “We committed to achieve 60 percent in small business subcontracting within five years and we are on track to meet that goal. More importantly, Sandia values our small business partnerships and we are pleased to see the growing number of new small businesses we subcontract with each fiscal year.”

Sandia also helps the state’s economy through the New Mexico Small Business Assistance program. In 2000, the state Legislature created the Laboratory Partnership with the Small Business Tax Credit Act to help companies get technical support from the national labs. In 2016, the Sandia NMSBA provided \$2.4 million in assistance to 198 New Mexico small businesses in 19

counties. It has provided \$53.3 million in assistance in all 33 counties since 2000.

## Supporting local nonprofits

Sandia employees gave more than \$5.2 million in 2017 to nonprofits in New Mexico, California, and the nation. Sandia also provided \$1.4 million in corporate contributions to support the work of local nonprofits. The Labs’ K-12 STEM (science, technology, engineering, and math) programs encouraged thousands of students to consider STEM careers. In addition to other community volunteer projects, Sandia employees worked with Girl Scout Troop 47 to transform a former jail into a winter shelter for the homeless on Albuquerque’s west side.

Delfinia says Sandia is committed to strengthening its existing relationships in the New Mexico business community and building new and enduring partnerships. “Sandia has a long and distinguished record of partnering with highly qualified, diverse small business suppliers,” she says. “We value their professionalism, innovation, and responsiveness. Sandia continues to be fully committed to maximizing small business opportunities and making a difference to the New Mexico economy.”





X-RAY VISION — Sandia researcher demonstrates new Sandia-designed radiation detection equipment for New START treaty monitoring. This new equipment detects neutron levels to confirm that objects are non-nuclear, as required for treaty inspections. (Photo by Randy Montoya)

# New radiation detectors developed at Sandia used for New START inspections

By Mollie Rappe

*Sandia researchers have designed, tested, and delivered new radiation detection equipment for monitoring under the New START treaty. Defense Threat Reduction Agency inspectors recently used this equipment for the first time in Russia for a New START inspection.*

New START, or the New Strategic Arms Reduction Treaty, is a treaty between the United States and Russia that, among other limits, reduces the deployed nuclear warheads on both sides to 1,550 this February. The treaty includes regular on-site inspections of warheads and delivery systems. These inspections require measurements of objects declared non-nuclear to confirm that they are non-nuclear. Specific neutron-detecting equipment is defined in the treaty for this confirmation.

The first generation of this equipment was designed by Sandia in the late 1980s. It was originally developed for the Intermediate-Range Nuclear Forces Treaty to discriminate between intermediate-range missiles that were prohibited by the treaty and strategic-range missiles that were not prohibited. The first-generation equipment was later approved for START and New START inspections, where the purpose was different but the measurements were the same.

The latest version of the radiation detection equipment is lighter, more rugged, and designed to be more sustainable into the future than the original generation of equipment. Just imagine trying to maintain a 30-year-old Walkman in a smartphone world.

### ‘A viable long-term solution’ for treaty verification

“It was getting to the point where the team was calling up retired vendors to see if they still had spare parts to repair the old equipment. That wasn’t a viable long-term solution,” says Dianna Blair, senior manager for Sandia’s nuclear security and nonproliferation group.

For equipment designed to last as long as the original equipment, it is important that it be rugged, robust, and produce reliable results.

The equipment was subjected to numerous tests to ensure its robustness and reliability. Mary Clare Stoddard, manager for arms control technology develop-

ment at Sandia, says, “Over the course of all the testing we did about 1,000 tests to stress the hardware. The carrying cases got a little thrashed but the hardware was fine.”

After the team of Sandia engineers and physicists designed equipment that would meet the needs of the treaty with modern parts, they invited some US inspectors to evaluate the prototypes. One of their tests involved rolling a calibrated detector down a steep hill, while in its carrying case, and then verifying that the equipment still gave accurate results. It did.

“The ability of this equipment to make reliable, accurate measurements after being kicked down a hill is pretty amazing,” Mary Clare says.

In addition to being able to take some hard use, the equipment doesn’t need to be calibrated as frequently and is lighter weight. The original set of equipment, containing two detectors and everything needed to set them up and operate them, weighed about 200 pounds and fit in four cases. The new equipment weighs 120 pounds and fits in three cases with wheels. Wheels aren’t helpful all the time, but on smooth surfaces they can be quite a boon.

“The Sandia team’s balance of technical excellence with pragmatic field-oriented engineering was key to coming up with the right product,” says Carolyn Pura, a former Sandia employee who now works at NNSA supporting New START.

### Russians inspect and approve radiation detectors

Before the new equipment was approved for on-site inspections, Pura and others were involved in lengthy discussions with Russia, our treaty partner. The Russians inspected the new equipment for 30 days as part of the treaty-defined process for approval.

The team fabricated and tested enough equipment to support New START inspections — fewer than 24 sets — made of a mixture of custom and commercially available parts. Though the equipment is essential for treaty inspections, it wouldn’t be profitable for a private company to specially design and produce so few systems, Mary Clare adds.

In addition to Sandia’s long history supporting non-proliferation and treaty verification efforts, the NNSA Office of Nuclear Verification, which funded the work, came to Sandia because of its nuclear weapons expertise. Mary Clare says, “This is our mission. We understand how design affects the measurements so we can advise on how to use the equipment in the field.”



# Supercomputing under a new lens:

## A Sandia-developed benchmark re-ranks the top computers

By Neal Singer



MIKE HEROUX

A Sandia software program now installed as an additional test for the widely observed Top500 supercomputer challenge has become increasingly prominent. The program's full name — High Performance Computing Gradients, or HPCG — doesn't come trippingly to the tongue, but word is seeping out that this relatively new benchmarking program is becoming as valuable as its venerable partner — the High Performance Linpack program — which some say has become less than satisfactory in measuring many of today's computational challenges.

"HPL used to represent a broad spectrum of the core computations that needed to be performed, but things have changed," says Sandia researcher Mike Heroux, who originated and developed the HPCG program. "Linpack performs compute-rich algorithms on dense data structures to identify the theoretical maximum speed of a supercomputer. Today's applications often use sparse data structures, and computations are leaner."

The term "sparse" means that a matrix under consideration has mostly zero values. "The world is really sparse at large sizes," says Mike. "Think about your social media connections: there may be millions of people represented in a matrix, but your row — the people

who influence you — are few. So, the effective matrix is sparse. Do other people on the planet still influence you? Yes, but through people close to you."

Similarly, for a scientific problem whose solution requires billions of equations, most of the matrix coefficients are zero. For example, when measuring pressure differentials in a 3-D mesh, the pressure on each node is directly dependent on its neighbors' pressures. The pressure in faraway places is represented through the node's near neighbors. "The cost of storing all matrix terms, as Linpack does, becomes prohibitive, and the computational cost even more so," says Mike. A computer may be very fast in computing with dense matrices, and thus score highly on the Linpack test, but in practical terms the HPCG test is more realistic, Mike says.

To better reflect the practical elements of current supercomputing application programs, Mike developed HPCG's preconditioned iterative method for solving systems containing billions of linear equations and billions of unknowns. "Iterative" means that the program starts with an initial guess to the solution, and then computes a sequence of improved answers. Preconditioning uses other properties of the problem to quickly converge to an acceptably close answer.

### Companies embrace new benchmark

"To address the problems we need to solve for our mission, which might range from a full weapons simulation to an National Renewable Energy Laboratory windfarm, we need to describe physical phenomena to high fidelity, such as the pressure differential of a fluid flow simulation. For a mesh in a 3-D domain, you need to know at each node on the grid the relations to values at all the other nodes. A preconditioner makes the iterative method converge more quickly, so a multigrid preconditioner is applied to the method at each iteration."

Supercomputer vendors like NVIDIA, Fujitsu, IBM, Intel, and Chinese companies write versions of HPCG's program that are optimal for their platform. While it might seem odd for students to modify a test to suit themselves, it's clearly desirable for supercomputers of various designs to customize the test, as long as each competitor touches all the agreed-upon calculation bases. "We have checks in the code to detect optimizations that are not permitted under published benchmark policy," says Mike.

On the HPCG Top500 list, the Sandia/Los Alamos supercomputer Trinity has risen to number 3, and is the top DOE system. Trinity is number 7 overall in the Linpack ranking. HPCG better reflects the Trinity design choices.

Mike says he wrote the base HPCG code 15 years ago, originally as a teaching code for students and colleagues who wanted to learn the anatomy of an application that uses scalable sparse solvers. Jack Dongarra and Piotr Luszczek of the University of Tennessee have been essential collaborators on the HPCG project.

In particular, Jack, whose visibility in the HPC community is unrivaled, has been a strong promoter of HPCG. "His promotional contributions are essential," says Mike. "People respect Jack's knowledge and it helped immensely in spreading the word. But if the program wasn't solid, promotion alone wouldn't be enough."

Mike invested his time in developing HPCG because he had a strong desire to better ensure the US stockpile's safety and effectiveness. The supercomputing community needed a new benchmark that better reflected the needs of the national security scientific computing community, he says.

"I had worked at Cray for 10 years before joining Sandia in '98," he says, "when I saw the algorithmic work I cared about moving to the labs for the Accelerated Strategic Computing Initiative (ASCI). When the US decided to observe the no-nuke-test treaty, we needed high-end computing to better ensure the stockpile's safety and effectiveness. I thought it was a noble thing, that I would be happy to be part of it, and that my expertise could be applied to develop next-generation simulation capabilities. ASCI was the big new project in the late 1990s, if you wanted to do something meaningful in my area of research and development."

Mike is now director of software technology for DOE's Exascale Computing Project. There, he works to harmonize the computing work of the DOE national labs — Oak Ridge, Argonne, Lawrence Berkeley, Pacific Northwest, Brookhaven, and Fermi, along with the three NNSA defense labs.

"We have an opportunity to create an integrated effort among the national labs," Mike says. "We now have daily forums at the project level, and the people I work with most closely are people from the other labs. Because ECP is integrated, we have to deliver software to the applications and the hardware at all labs. DOE's attempt at a multi-lab project gives an organizational structure for us to work together as a cohesive unit so that software is delivered to fit the key DOE applications."

Among Mike's achievements, he served for six years as editor-in-chief of ACM's *Transactions on Mathematical Software*, and is a senior scientist at Sandia.

# Your commuting 'footprint' at a glance

## New commuter website offers insights about environmental impact

By Valerie McKinney

Sandia's commuter assistance website ([https://info.sandia.gov/commuter\\_assistance/index.php](https://info.sandia.gov/commuter_assistance/index.php)) has just gotten easier to use, as well as more informative.

Last month, the Labs' Environmental Management organization unveiled its updated Commuter Assistance website, with a new, user-friendly platform. There, you can easily sign up for (as well as renew) your carpool pass. You can also quickly find carpools in your area, and even explore the possibility of incorporating that into your commuting routine.

The update will include the capability to track your commute, while estimating your greenhouse gas emission footprint. By inputting the make, model, and year of your vehicle along with how often you use that vehicle in a two-week period (taking account for the 9/80, or 4/10 options) the site translates that information into a graph on your dashboard. You can then see the effect small changes to your weekly commute could have on that greenhouse gas footprint. What it will represent is, you currently vs. you potentially.

DOE Order 436.1 states that Sandia shall work toward meeting the sustainability requirement and "reduce Scope 3 emissions by 25 percent by FY 2025, relative to an FY 2008 baseline."

Scope 3 greenhouse gas emissions are six categories of emissions from sources not owned or directly controlled by Sandia: employee commuting, business air travel, business ground travel, transmission and distribution losses from purchased electricity use, contracted solid waste disposal, and contracted waste water treatment.

Sandians produce an estimated 40,000 metric tons



Join a Carpool



Benefits of Commuting



Differences & Incentives (Guaranteed Ride Home)



External Resources

of greenhouse gas emissions every year by driving to work, accounting for more than 50 percent of Sandia's Scope 3 emissions. However, if 1/3 of the workforce (current telecommuters excluded) drove to work one day a week less, the Labs Scope 3 footprint would be cut by almost 2,200 metric tons.

The website presents a variety of commuting options, with links to resources, available at the site that could benefit employee health and work-life balance, and help reduce not just emissions, but expenses too. These include riding your bicycle, driving an all-electric vehicle, carpooling, telecommuting, and more.

Ben Henning, one of the project leads of the website update and the SME assigned to the site, says small, sustainable changes have powerful long-lasting repercussions. He says he thinks the new website can make a big difference in how Sandians think about getting to work.

"Far and away what I like best about the new site is the Commuter Profile's capacity to compare and contrast my annual GHG footprint based on different commute types and work schedules. This tool allows me, or

anyone else, to get a really good grasp of how I can realistically take control of and have responsibility for the quantity of greenhouse gases I emit when commuting each week. I find that very empowering."

This project has involved exceptional collaboration between the California and New Mexico sites, Ben says, since this interface must work for both locations.

Best case scenario is for the entire workforce's information be available in the site's database. That will afford EMS optimum data for tracking and forecasting progress toward the emissions reduction goal.

"This is another example of how we, as a national lab, demonstrate good stewardship to the environment," says Jaime Moya, director of ES&H. Jaime strongly supports the initiative, and ES&H plans to implement capturing the vehicle data as part of ESH100.

In addition to reducing Sandia's overall GHG footprint, this new tool is designed to make the workforce think about their commute and its impact. These efforts can and will make a significant impact and is only part of what the environmental area of ES&H does every day.



SANDIA CLASSIFIED ADS

MISCELLANEOUS

MEN'S WATCH, Casio Pro Trek, solar powered, triple-sensor, black resin strap, altimeter, barometer, compass, thermometer, great condition, \$60. Dwyer, 505-249-6935.

FUTON, metal frame, black, photos available, \$75. Hanks, 249-1931.

COMPOUND BOWS, \$150-\$350; tire chains, 1 set, 265/70/18, \$130; flat jewelry showcase, \$100. Schroeder, 917-4516.

DINING TABLE, w/empire pedestal base, 54-in. round, quarter-sawn oak, antique, original finish, good condition. Hubbard, 505-293-2819.

RECLINER COUCH, La-Z-Boy, gray leather, 2-seat standard sofa width, pristine, 2 mos. new, \$975 OBO. Sanchez, 505-974-1655.

CHILDREN'S TOYS: motorized quad bike; tricycle; wooden assembled playhouse; shopping cart; backpack baby; bouncer. Stephenson, 238-5825.

BDR. SET, 4-pc., queen/full, w/bed, nightstand, dresser, chest-of-drawers, Cherrywood, \$750. Usher, 505-507-4744, ask for Josh.

REFRIGERATOR, GE Profile, \$75; solid wood bistro set, \$85; Floormate hard floor cleaner, \$50; entertainment center, \$75; golf clubs, Ping Eye2 irons, more, \$135. Mills, 217-621-2492.

TIMESHARE, Cliff's Resort, Princeville Kauai HI, pick your week, \$1,100. Petraglia, 459-6195.

REFRIGERATOR, GE, 19-cu. Ft., \$100 OBO; oak headboard, for twin bed, \$65. Lott, 228-8317.

PIANO, Yamaha, studio upright, 50-in high, almost 2 yrs. old, \$15,000 new, asking \$11,000. Crane, 286-1230.

TREADMILL, ProForm, \$200; 44-bottle wooden wine rack, \$25; carpet cleaner, \$60. Sutton 202-450-7359.

INKJET CARTRIDGES, 3, new: DellT0529, DellT0530, \$3 ea.; HP60XL, cost \$50, asking \$25. Vrooman, 505-249-8414.

TRANSPORTATION

'06 JEEP RUBICON, AT, soft & hard tops, 128K miles, original owner, dealer serviced, \$15,200. Gurule, 505-263-4178.

'11 INFINITI G37x COUPE, sapphire blue, no accidents, full records, 1 owner, 73K miles, \$15,500 OBO. Mathews, 505-379-1430.

'99 CORVETTE, 6-spd. manual, Targa top, silver, Carfax available, 38K miles, \$13,500. Elliott, 505-681-9808, ask for Rick.

'07 PORSCHE CAYMAN S, 6-spd., silver creampuff, black leather sport seats, customizable, 49.5K miles, \$24,000-\$25,000. Murata, 881-8459.

'10 BMW E92 MS, RWD, V8 engine, 78K miles, excellent condition, \$29,000 OBO. Platzbecker, 505-269-4714.

'91 HONDA ACCORD LX, 285K miles, good condition, selling as is, \$1,800 cash OBO. Nishida, 916-267-7277, send text.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.

Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: From Techweb search for 'NewsCenter', at the bottom of that page choose to submit an ad under, 'Submit an article'. If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.



'09 TOYOTA PRIUS, leather seats, 102K miles, one owner, well maintained, \$6,700. Byers, 505-620-9914.

'00 BMW M5, manual transmission, RWD, black, 128K miles, \$13,000. Deibler, 509-205-2525, ask for Ken.

'13 TOYOTA HIGHLANDER LIMITED, AWD, 78K miles, warranty, \$21,900 OBO. Sahlstrom, 505-923-0135.

'07 BMW 530i, silver, grey leather, 92K miles, excellent condition, 2nd owner, no accidents, \$8,000. Guerrero, 505-379-4939.

RECREATION

'14 OUTBACK TERRAIN 210TRS TRAVEL TRAILER, 23-ft., rear slide, bunks, great condition, \$20,500 OBO. Crespin, 505-459-5199.

'17 FOREST RIVER XLR 29HFS TRAVEL TRAILER, Toy-hauler, only used once, like new condition, \$24,495. Greer, 281-4688.

'17 FR3 32DS BUNKHOUSE MODEL, A Class, Ford V10, sleeps 8, double refrigerator, 4 TVs, \$83,000. Richmond, 650-885-6588.

'12 HARLEY-DAVIDSON SPORTSTER, 1200 Custom, 19K miles, pristine condition, many extras, w/Harley-Davidson helmet, \$6,500. Atencio, 249-8395.

REAL ESTATE

4-BDR. HOME, 1,740-sq. ft., NE Heights, soundproof bonus room, MLS#907735, \$169,000. Cappadona, 334-717-8136.

TWO-STORY HOME, in Santiago, DR, AC, mango, avocado, more, call for more info, \$90,000. Pimentel, 823-2934, ask for Alex.

3-BDR. HOME, 3 baths, 2,296-sq. ft., Willow Wood neighborhood, must see. Martinez, 505-459-4451.

3-BDR. HOME, 2,260-sq. ft., new windows, carpet, numerous upgrades, 10 mins. to base, Foothills, MLS#908333, vimeo.com/251396176. Romanelli, 505-205-5376.

2-BDR. HOME, 1 bath, remodeled, 926-sq. ft., granite, new plumbing/sewer, mechanical, electrical, wood floors, xeriscape, Ridgecrest/Monroe, \$225,000. Dussart, 505-450-8535.

WANTED

CHILD CARE, experienced person, take care of 1-yr. old grandson, M, T, TH, F, 2 hrs./day in grandson's NE Heights home. Weagley, 505-385-4059.

MOVING BOXES, will come & pick up. Melkey, 319-538-6152.

OLD ELK/DEER MEAT, almost any meat, for my dogs, clear out that freezer. Beggs, 450-7303.

LOST AND FOUND

FOUND, Jan. 22, men's silver ring, parking lot between F Ave. & NCO Bypass. Holzrichter, 844-3898.

Mileposts



New Mexico photos by Michelle Fleming



Gary Polansky 35



Karla Simoes 25



Clinton Hobart 20



Jay Smith 20



Todd Houchens 15

Recent Retirees



New Mexico photos by Michelle Fleming



Anthony Medina 38



George Moore 38



Timothy Wheeler 37



Paul Taylor 36



Dorothy Meister 34



Orlando Griego 33



Elsa Glassman 27



Kevin Seager 27



Ralph Wrons 27



Melecita Archuleta 25



Robert Grothe 25



Regina Griego 20



# National Hispanic engineering organization honors two Sandia weapons engineers

By Kristen Meub

**T**he technical achievements of two Sandia weapons engineers have been recognized by Great Minds in STEM, an organization supporting careers in science, technology, engineering and math.

Systems Analysis manager Steven Trujillo was awarded for his professional achievements and Humberto Santacruz, a lead engineer on Sandia's W76-1 System Life Extension Project, received a Most Promising Engineer Advanced Degree — Master's award. Steven and Humberto were recognized at the 29th Annual Hispanic Engineer National Achievement Awards Conference in Pasadena, California, last fall. Deputy Laboratories Director Dave Douglass and Associate Laboratories Director Scott Aeilts presented the two engineers with their awards at the ceremony.

## Steven Trujillo

Steven joined Sandia in 1999 and has advanced through what he describes as five different careers at



STEVEN TRUJILLO

Photo courtesy of Great Minds in STEM • HENAAC Conference

## HENAAC 2018 call for nominations

The October 2018 conference will be the 30th HENAAC conference. For the past 29 years, the Hispanic Engineer National Achievement Awards Conference has been honoring the nation's best and brightest Hispanic engineers, scientists, and technology experts.

Since its inception, HENAAC has honored 38 Sandians for their engineering, leadership, national, and community contributions. Now is your opportunity to nominate your colleagues who deserve this recognition.

This is not only recognition for the contributions of our Sandians. By highlighting and showcasing outstanding role models, Sandia and HENAAC hope to inspire young people to pursue careers in Science, Technology, Engineering, and Math while also motivating professionals to continue to connect with the Hispanic community. Nominating Sandians for these awards brings positive attention to our organization and mission work, promotes our diversity efforts, and recognizes the outstanding contributions and achievements of our Hispanic engineers and scientists. Each year, the nomination provides Sandia National Laboratories with the ability to recognize our talented workforce.

Please refer to the HENAAC website at <http://www.greatmindsinstem.org/> for nomination award categories. Sandia has developed a process to ensure submission of excellent nominees. The first step in this process is for nominators to prepare a one-page pre-nomination form, which can be found on the HOLA SharePoint under Announcements.

the Labs before moving into his current role as a manager. His first position was in engineering sciences as a postdoctoral appointee.

He then moved on to weapons engineering, systems analysis, and a Washington, D.C., post as Sandia's resident technical adviser to NNSA's deputy administrator for Defense Programs. He has contributed to two presidential policy directives, one that expanded a 30-year policy on nuclear weapon safety and security and



HENAAC AWARDS GALA — Sandia HENAAC award recipients Steven Trujillo (front row, left center) and Humberto Santacruz (back row, right center) are joined in a celebratory moment with some of the Sandia delegation who attended the ceremony. From left to right: Jennifer Leute, Scott Aeilts, Tally Lobato, Miquelita Carrion, Patricia Hernandez, Rebecca Lopez, Steven Trujillo, Illiana Gamboa (Humberto Santacruz's wife), Humberto Santacruz, Roberta Rivera, Julie Cordero, Dan Briand, Carrie Ross, Rafael Gonzales, Edward Jimenez, and Jamie Moya. Not pictured are Sandia Deputy Labs Director Dave Douglass, Scott Holswade, Nick DeRue, and Anna Schauer.

another focused on national security threat awareness and nuclear enterprise assurance.

In his recommendation letter, Donald Cook, former NNSA deputy administrator for Defense Programs, wrote that in Steven's advisory role to key government agencies and in other positions, "Steven quickly became a trusted part of a national team focused on some of the most important national security issues, due to the depth of his technical knowledge, his easy interaction with colleagues, and his drive to make nationally important contributions."

Steven grew up in Santa Fe and remains involved in the community. He is a member of the Sociedad Proteccion Mutua de Trabajadores Unidos, a Hispanic worker and cultural protection society founded in the early 1900s, and he has volunteered and served as a board member for the Cancer Foundation for New Mexico, which provides nonmedical services to people receiving cancer care in Santa Fe.

"In New Mexico, we are spread out and cancer treatment can be far away," Steven says. "Imagine having to commute from someplace like Raton to Santa Fe for chemotherapy during the winter when you are on a low income. The foundation buys gasoline, hotel nights, and groceries for people in that and similar situations. We have been fortunate and successful in our fundraising, so we are able to help a lot of patients. We also provide snacks and companionship while people are undergoing chemo."

Steven received a bachelor's degree in aeronautical and astronautical engineering from Purdue University, a master's degree in mechanical engineering from the University of New Mexico, and a doctorate in mechanical engineering from the University of Texas at Austin. He was a principal adviser for a Sandia documentary film, *On Deterrence*, and has received an NNSA Defense Programs Award of Excellence and the Sandia President's Quality Award.

## Humberto Santacruz

Humberto joined Sandia in 2011 and holds a lead position in weapons systems engineering. Previously, he served as a lead electrical engineer and completed Sandia's Weapon Intern Program.

"I first got to know Humberto when we were facing significant engineering production challenges on one of Sandia's most critical programs," Sandia director Toby Townsend says. "I was impressed by his initiative and candor. He showed strong analytical and problem-solving skills, and for those qualities I was eager to have him lead projects within Sandia's nuclear weapons program."

Humberto says he enjoys the daily challenges of engineering and leadership, interacting with customers and co-workers, learning something every day, and taking on new opportunities.

"Humberto is an up-and-coming engineer who already has established a distinguished record of techni-

cal accomplishments, exceptional leadership, and personal commitment to Sandia and his community," Sandia Labs president Steve Younger says. "He is a role model and mentor to newer employees at Sandia and has a passion for contributing to the community and focusing on work with youth."

Humberto says he is honored and humbled to be recognized by HENAAC and his entire leadership team, and he was proud to share the award ceremony with his parents and family.

"My parents are the main reason I am here and do what I do," he says. "My dad taught me to care about how to build and fix things, and my mom made it so that my only job growing up was to go to school. I was born in the US, but we lived in Juarez, Mexico, until I was in third grade. My parents moved back to the US so my brothers and I could get a better education. My father always said that 'education opens doors.'"

Humberto is passionate about giving back and inspiring youth to focus on education. He mentors high school students in calculus and other subjects, he speaks at career days to encourage children to become scientists and engineers and he recruits students to study at his alma mater — the University of Texas at El Paso, where he received his bachelor's and master's degrees in electrical engineering. He is also involved with his church, serving as a choir director and teaching in the youth ministry program.



HUMBERTO SANTACRUZ

Photo courtesy of Great Minds in STEM • HENAAC Conference